6.2.2 Classwork

Name_______________ Date________

What is a logarithm?
Defining the Inverse of an Exponential Function

today's big goal You'll find a definition of a logarithm as the inverse of the exponential function.

So far, you have learned how to "undo" many different functions. However, the exponential function has posed more difficulty. In this lesson, you will learn more about the inverse exponential function. In particular, you will learn how to write an inverse exponential function in *y-form.*

6-67 Silent Board Game

x	8	32	$\frac{1}{2}$	1	16	4	3	64	2	0	0.25	-1		0.2	$\frac{1}{8}$
$g(x)$	3		-1					6					$\frac{1}{2}$		

a. Describe a rule that relates x and g(x).

b. Look back to the Ancient Puzzle in problem 6-56. If you haven't already, use the idea of the Ancient Puzzle to write an equation for *g(x)*.

c. Why was it difficult to think of an output for the input of 0 or –1?

d. Find an output for x = 25 to the nearest hundredth.

6-68 Another Logarithm table

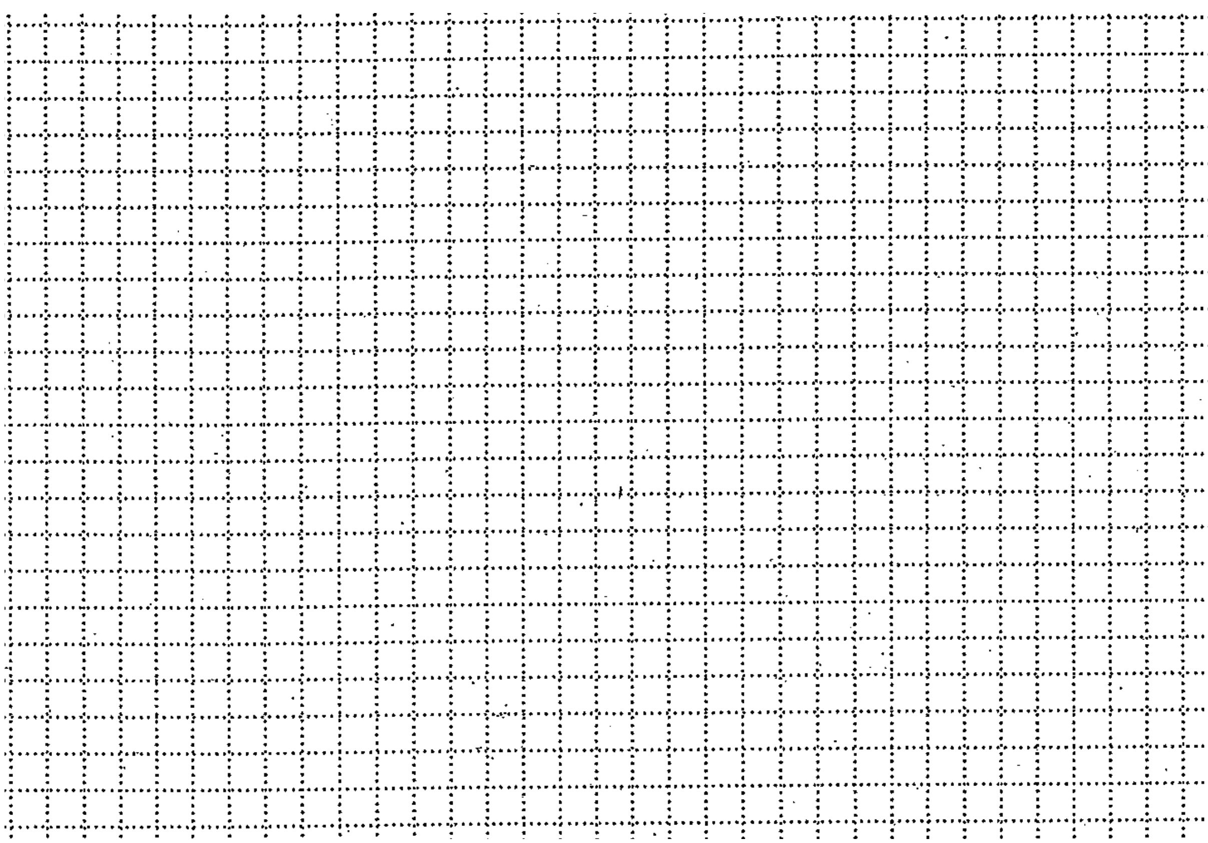
x	$\frac{1}{25}$	$\frac{1}{5}$	$\frac{1}{2}$	1	2	3	4	5	6	7	8	10	25	100	125	625
$g(x)$		-1		0				1					2		3	

a. Discuss with your team which outputs can be filled in without a calculator. Fill those in and explain how you found those entries.

b. With your team, use your calculator to estimate the remaining values of *g(x)* to the nearest hundredth. Once you have entered several, use your knowledge of exponent rules to see if you can find any shortcuts.

c. What do you notice about the results for *g(x)* as *x* increases?

d. Use your table to draw the graph of $y = \log_5 x$. How does your graph compare to the graph of $y = 5^x$?



→ **Logarithm card game**: First player to get exactly 21 points wins!

6-69 Find each of the values below, and then **justify** your answers by writing the equivalent exponential form.

a. $\log_2(32) = ?$ Equivalent exponential form:	b. $\log_2(\frac{1}{2}) = ?$ Equivalent exponential form:	c. $\log_2(4) = ?$ Equivalent exponential form:	d. $\log_2(0) = ?$ Equivalent exponential form:
e. $\log_2(?) = 3$ Equivalent exponential form:	f. $\log_2(?) = \frac{1}{2}$ Equivalent exponential form:	g. $\log_2(\frac{1}{16}) = ?$ Equivalent exponential form:	h. $\log_2(?) = 0$ Equivalent exponential form:

6-70

Have your REPORTER/RECORDER read the instructions: While the idea behind the Ancient Puzzle is more than 2100 years old, the symbol **log** is more recent. It was created by John Napier, a Scottish mathematician in the 1600's. "Log" is short for **logarithm,** and represents the function that is the **inverse of an exponential function.** You can use this idea to find the inverse equations of each of the following functions.

Find the inverses and write your answers in *y-form.*

a. Original function: $y = \log_9(x)$	b. Original function: $y = 10^x$
Inverse (in y-form):	Inverse (in y-form):

c. Original function $y = \log_6(x+1)$	d. Original function: $y = 5^{2x}$
Inverse (in y-form):	Inverse (in y-form):

→Inner circle, outer circle

6-71 Practice your logarithm fluency by calculating each of the following, *without changing the expressions to exponential form.* Be ready to explain your thinking.

a. $\log_7 49 =$ __

b. $\log_3 81 =$ __

c. $\log_5 5^7 =$ __

d. $\log_{10} 10^{1.2} =$ __

e. $\log_2 2^{w+3} =$ __